# Use of the IEEE 802.16 Operator ID with IEEE Std 802.16 Wireless Metropolitan Area Networks

## General

IEEE Std 802.16 defines a 24-bit Operator ID to identify the operator of an IEEE 802.16 base station. The 24-bit Operator ID shall be assigned as an IEEE 802.16 Operator ID by the IEEE Registration Authority (IEEE-RA). The IEEE-RA is the sole authorized number space administrator for this function.

This Operator ID (OpID) is combined with an additional 24-bit programmable field to define the 48-bit Base Station ID (see subclause 6.3.2.3.2 in IEEE Std 802.16).

Provided that the operator assigns unique numbers to the least significant 24 bits of the Base Station Identifier, this results in a globally unique Base Station Identifier, as long as the OpID is globally unique.

## IEEE 802.16 Operator ID

The IEEE 802.16 OpID is a sequence of 24 bits administered by the IEEE-RA.

## Base Station ID

A Base Station ID is defined as a sequence of 48 bits. The first 24 bits take the values of the 24 bits of the OpID in order; the following 24 bits are administered by the base station operator.

For example, the OpID 111111110011111111101000 could be used to generate the following Base Station ID by appending 000000001000000010000000:

111111110011111111101000 000000001000000010000000

| |

|first bit transmitted last bit transmitted|

## Assignment of Operator ID

There are three typical use cases for the OpID.

1. Globally Unique OpID assigned by IEEE
   A network may have a number of 802.16 compliant base stations, located in one or more countries. In this case, the operator requires a globally unique OpID assigned by the IEEE-RA. Many operators will need only a single OpID.

An operator may request up to 100 contiguous OpIDs. The IEEE-RA allocates OpIDs.

2. Globally Unique OpID derived from E.212 MCC-MNC
   Many cellular networks make use of the Mobile Country Code - Mobile Network Code (MCC-MNC) format specified by ITU E.212[1] for network identification. The operator may desire a unique IEEE 802.16 OpID based on an existing E.212 assignment. A procedure to map the MCC-MNC format to the OpID accommodates any need (e.g., one based on regional regulations) to use an OpID derived from an allocation made by a regional allocation authority. This procedure is acceptable only for operators who have been expressly allocated an appropriate MNC, and only within the specified MCC region under the appropriate national authority, according to the E.212 process.

   The MCC-MNC is encoded into an IEEE 802.16 OpID as follows:

   i. The OpID shall begin with the bits "1111"
   ii. The next 10 bits are a binary representation of the 3 digit decimal number comprising the MCC; e.g., MCC 302 is represented as 0100101110.
   iii. The final 10 bits are a binary representation of the 3 digit decimal number comprising the MNC; e.g., MNC 573 is represented as 1000111101.
   iv. 2-digit MNCs are encoded as if they are prefixed with zero to create a 3-digit number. This encoding will be unambiguous because no MCC supports both 2- & 3-digit MNCs, per the E.212 requirement [2] that "For a specific shared MCC, the length of all MNCs within that MCC shall be the same." For example, MNC 38 is encoded as 0000100110; MNC 99 is encoded as 0001100011.
   v. Examples:
      - The E.212 MCC-MNC pair 310-185 would be encoded 1111 0100110110 0010111001.
      - The E.212 MCC-MNC pair 234-02 would be encoded 1111 0011101010 0000000010.
      - The E.212 MCC-MNC pair 450-185 would be encoded 1111 0111000010 0010111001.

   The IEEE-RA assumes no responsibility for any actions regarding these E 212-derived OpIDs, except to specify the algorithm. The IEEE-RA does not maintain a registry of numbers calculated according to this process and does not accept responsibility for arbitrating any disputes.

3. Public OpID pool
   Networks not offering public service may operate a small number of IEEE 802.16 base stations. In such cases, the network operator (which may be, for example, a residential user or a small enterprise) may be tolerant of a nonunique OpID. To support such private operators, a large pool of public OpIDs is available (see table below) for use without IEEE assignment. Note that these numbers are not globally unique and are not recommended for use in systems providing public service. Commercially available IEEE 802.16 base stations for private use should be pre-populated with an OpID randomly selected from the Public OpID Pool but should allow the operator to reprogram the OpID to any value from the Public OpID Pool, but to no other value. This ensures that operators with multiple IEEE 802.16 base stations can program all of their base stations to the same OpID.

| Status | Binary | Hex | Decimal | Notes |
|---|---|---|---|---|
| First Public OpID | 111111110001111111101000 | FF9FE8 | 16752616 | The 24,600 largest numbers in the space, all starting with "1111", are reserved for the Public OpID pool with the exception of the largest number, which is reserved and not included in the Public OpID Pool. |
| Last Public OpID | 111111111111111111111110 | FFFFFE | 16777214 | |
| Reserved | 111111111111111111111111 | FFFFFF | 16777215 | |

4. OpIDs Assigned Explicitly by IEEE-RA
   Except for the Public OpID pool (see (3) above) and for OpIDs that can be generated using the mapping defined in (2) above, all other OpIDs in the space are for use only by a user with a specific allocation from the IEEE-RA (1) above.

**Operator ID Usage**

The OpID referenced in the assignee's IEEE-RA Assignment is described as a 24-bit globally assigned OpID and as an integral part of a 48-bit globally assigned Base Station ID. An OpID assignment allows the operator to generate approximately 16 million Base Station IDs, by varying the last three octets.

The method that an operator uses to ensure that no two of its Base Stations carry the same ID will, of course, depend on the assignment process and the operator's philosophy. However, the network selection algorithms may expect Base Stations to have unique IDs. The ultimate responsibility for assuring that expectations and requirements are met, therefore, lies with the operator of the Base Station.

## Annex: Table of Allocations

Note: Refer to text for details.

| Status | Binary | Hex | Decimal | Notes |
|---|---|---|---|---|
| Reserved | 000000000000000000000000 | 00000 | 0 | 25% of the 24-bit space (all numbers beginning with bits "00") is allocated for IEEE-assignable OpIDs, except 0, which is excluded. This provides 4194303 ($2^{24}$-1) OpIDs. |
| First IEEE-assignable OpID | 000000000000000000000001 | 000001 | 1 | |
| Last IEEE-assignable OpID | 001111111111111111111111 | 3FFFFF | 4194303 | |
| First reserved OpID | 010000000000000000000000 | 400000 | 4194304 | Reserved for future use. Includes all numbers beginning with bits "01", "10", and "11" except those beginning with "1111". In all, 11,534,336 numbers (11/16 of the space) are reserved. |
| Last reserved OpID | 111011111111111111111111 | EFFFFF | 15728639 | |
| First E.212-based OpID | 111100000000000000000000 | F00000 | 1572864 | All E.212-derived OpIDs begin with bits "1111". The next 10 bits represent the three-digit MCC; the next 10 bits represent the MNC. OpIDs beginning with "1111" but not obtainable from any possible MCC-MAC by this formula are reserved. |
| Last E.212-based OpID | 111111111001111111100111 | FF9FE7 | 16752615 | |
| First Public OpID | 111111111001111111101000 | FF9FE8 | 16752616 | The 24,600 largest numbers in the space, all starting with "1111", are reserved for the Public OpID pool with the exception of the largest number, which is reserved and not included in the Public OpID pool. |
| Last Public OpID | 111111111111111111111110 | FFFFFE | 16777214 | |
| Reserved | 111111111111111111111111 | FFFFFF | 16777215 | |

[1] ITU-T Recommendation E.212 (05/2004, including Erratum 1 [10/2004]), "The international identification plan for mobile terminals and mobile users," May 2004